Diamond Grinding of PCC Bridge Decks and Pavements

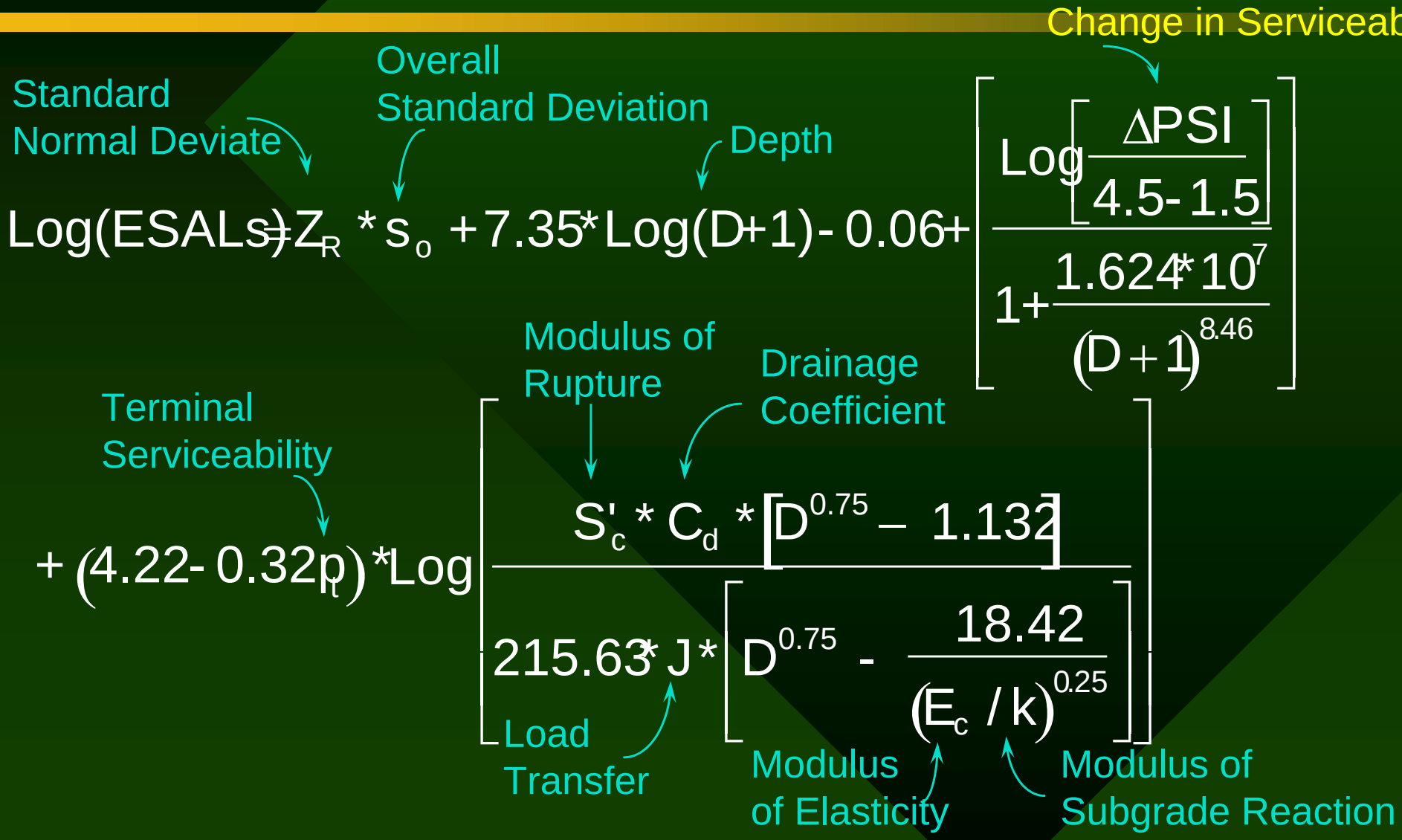
Increased Pavement Performance and Customer Satisfaction Using Diamond Grinding

THE ULTIMATE QUESTION!

- *How do I make limited budget dollars stretch and provide a highway system that offers a high level of service?*

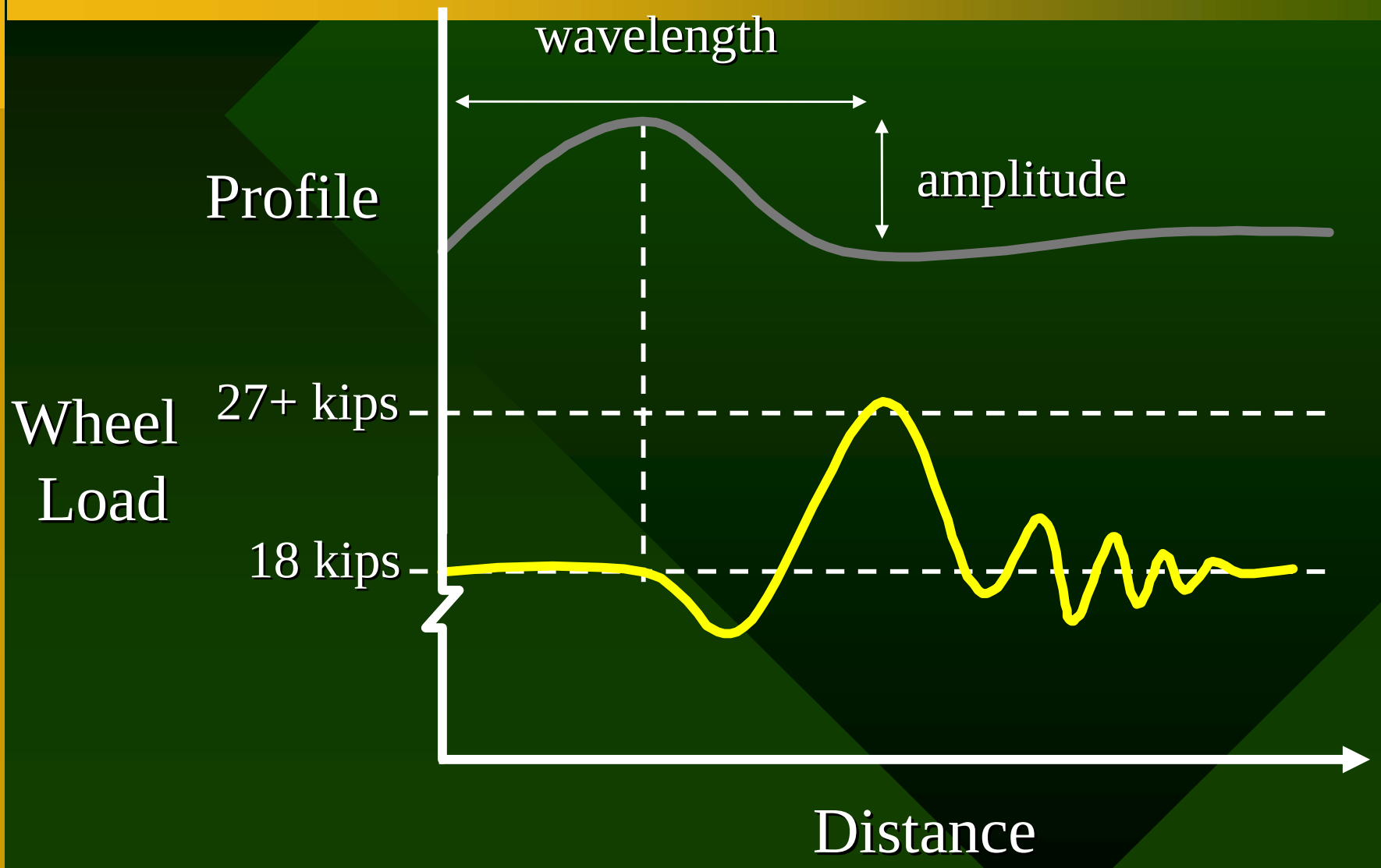

202
35
ONE
WAY

1986-93 Rigid Pavement Design Equation

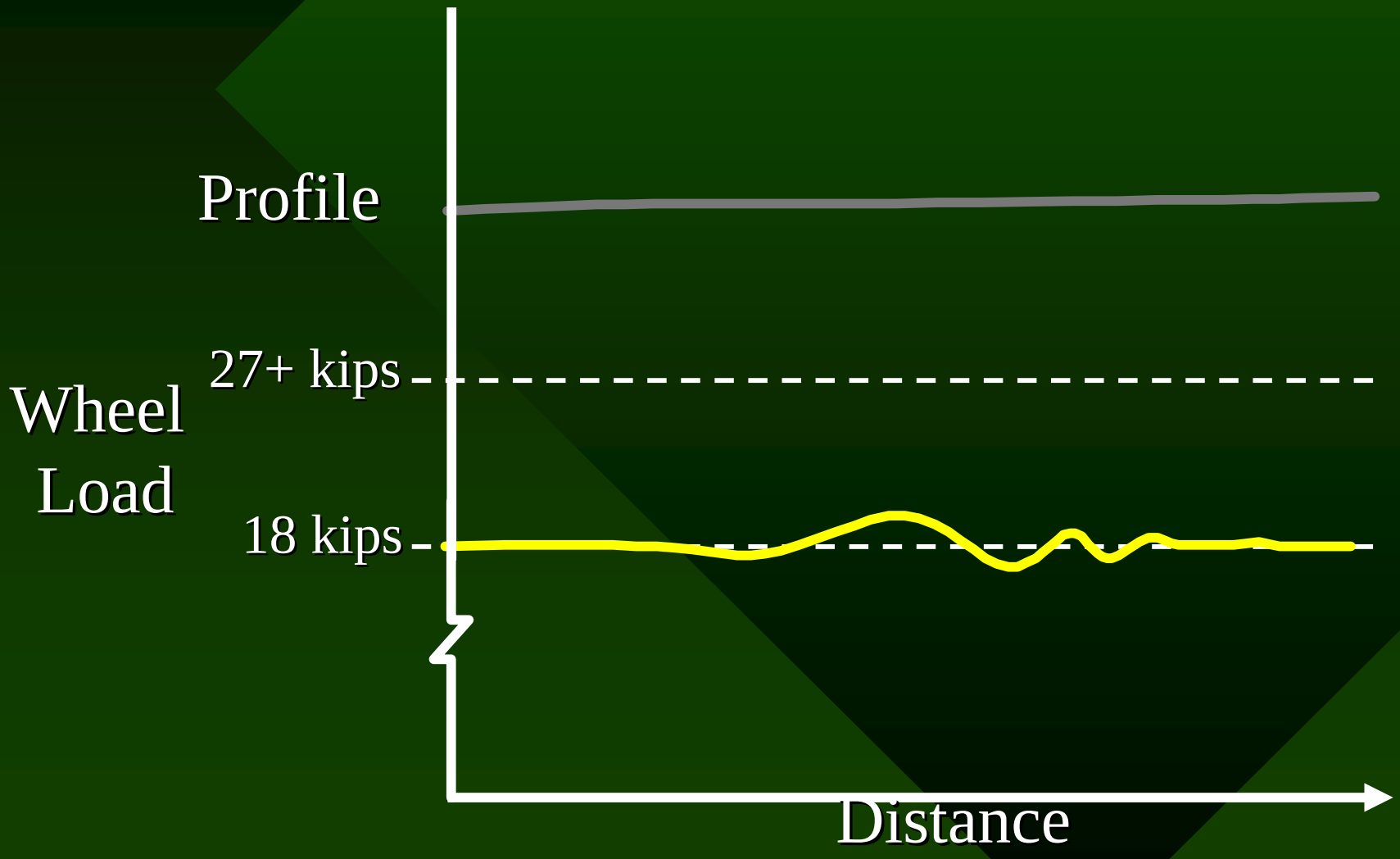


SMOOTH PAVEMENTS LAST LONGER!

Rough Pavement



Smooth Profile

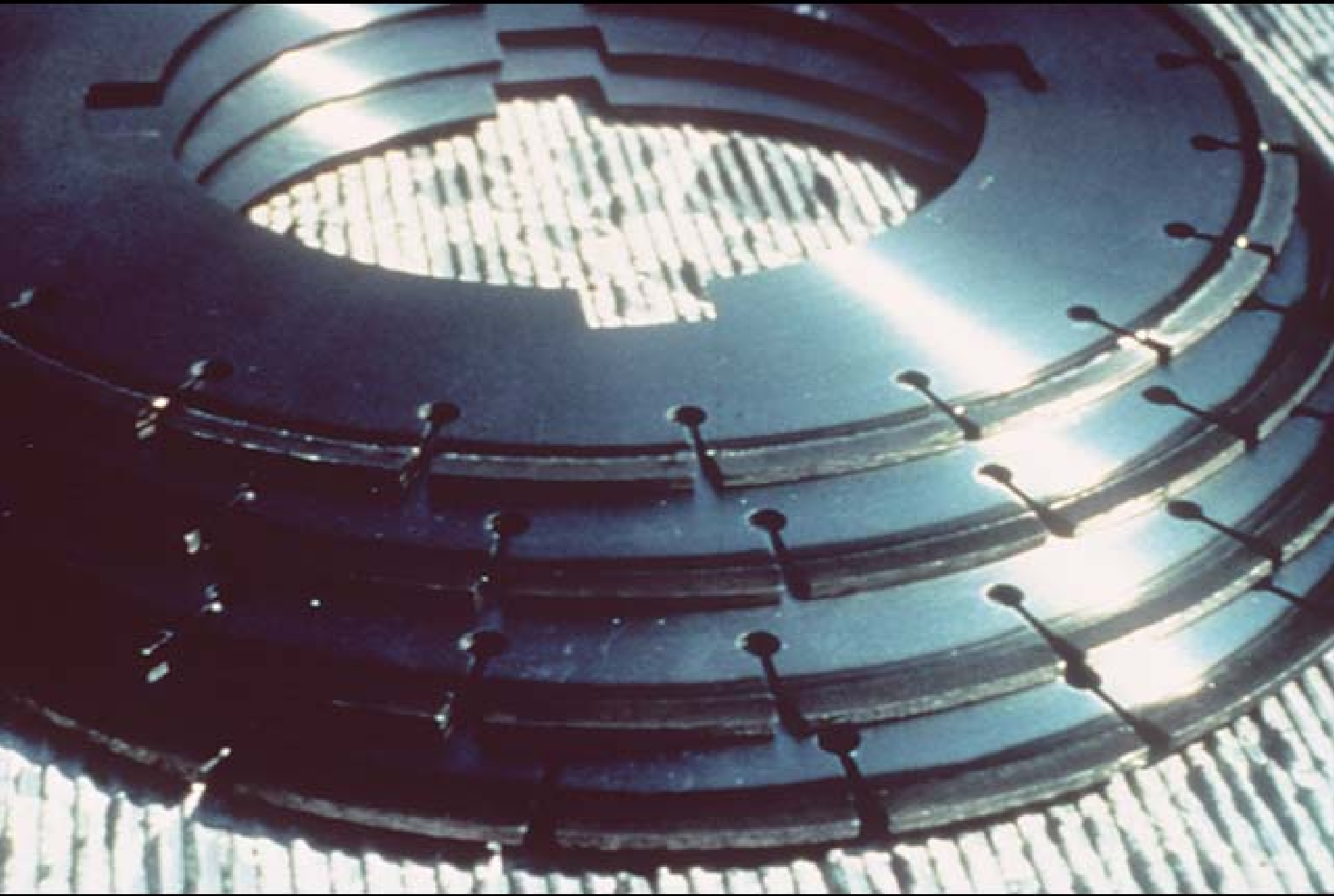


Diamond Grinding

Grinding

What is Diamond Grinding?

- Removal of thin surface layer of pavement using closely spaced diamond saw blades
- Results in smooth, level pavement surface
- Longitudinal texture with desirable friction and low noise characteristics
- Comprehensive part of any Pavement Preservation program



Diamond Grinding

Cutting Head

Grinding

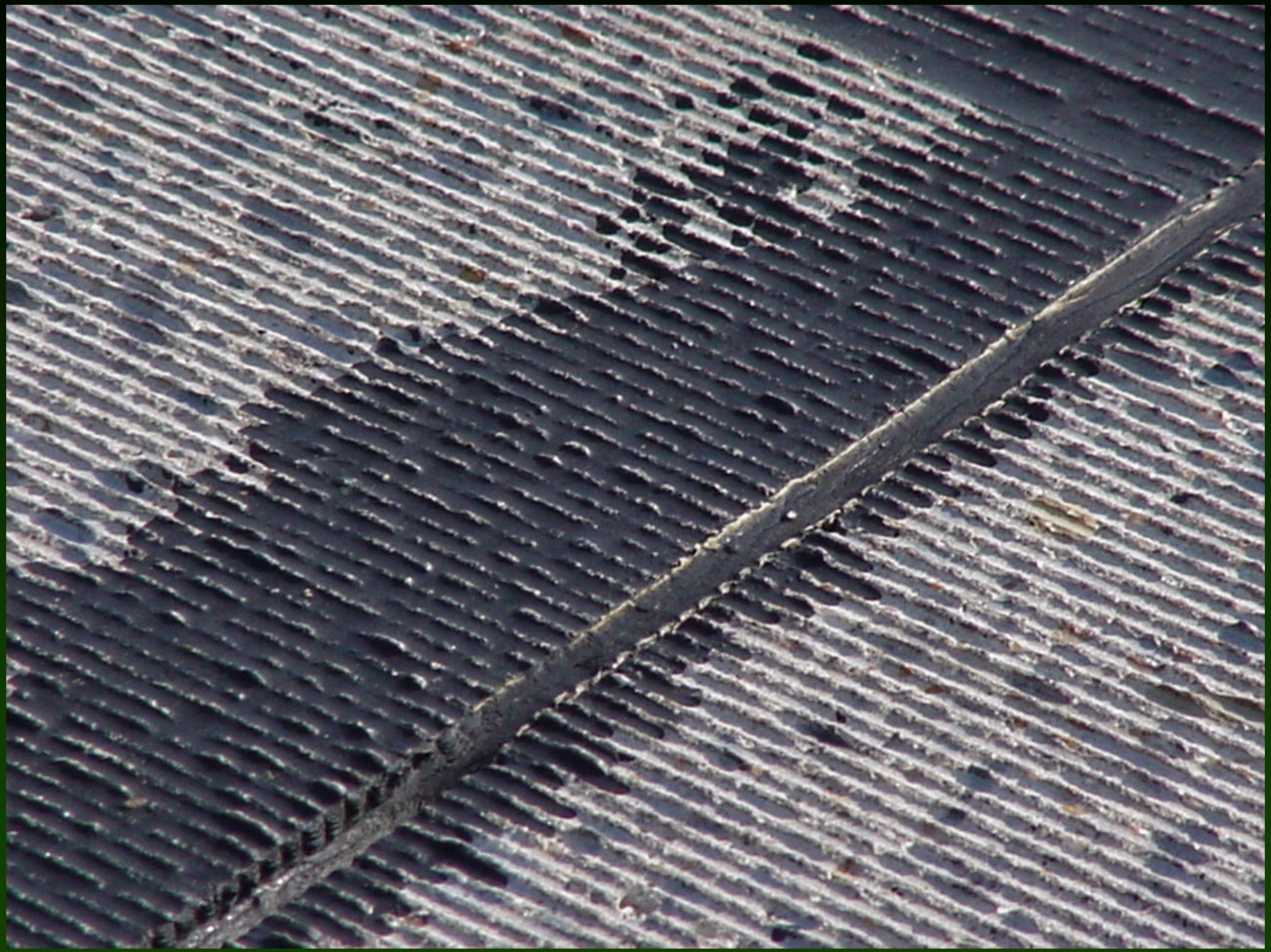
Diamond Grinding

Grinding Machine

Grinding

Diamond Grinding

Grinding



Diamond Grinding Was Invented in California

- Diamond grinding was first used in California in 1965 on a 19-year old section of I-10 to eliminate significant faulting (Neal and Woodstrom 1976)
- In 1983, CPR was conducted on this same pavement section, including the use of additional grinding to restore the rideability and skid resistance of the surface. In 1997, the process was repeated
- Since its first use in 1965, the use of diamond grinding has grown to become a major element of PCC pavement preservation

Advantages of Diamond Grinding

- Can be used on bridge decks, PCC and AC pavement
- Costs substantially less than AC overlays
- Enhances surface friction and safety
- Can be accomplished during off-peak hours with short lane closures and without encroaching into adjacent lanes
- Grinding of one lane does not require grinding of the adjacent lane
- Does not affect overhead clearances underneath bridges
- Blends patching and other surface irregularities into a consistent, identical surface

Bridge Decks

Bridge Decks

- Used in MN, IA, TN, FL, AL, SC, OH, NY
- Allows for quick identification of distress
- Does not retain moisture, dries quickly
- Smooth surface minimizes dynamic loading
- Allows for quick application of curing compound
- Quiet
- Safe
- Low maintenance

Asphalt Pavement

Asphalt Pavement

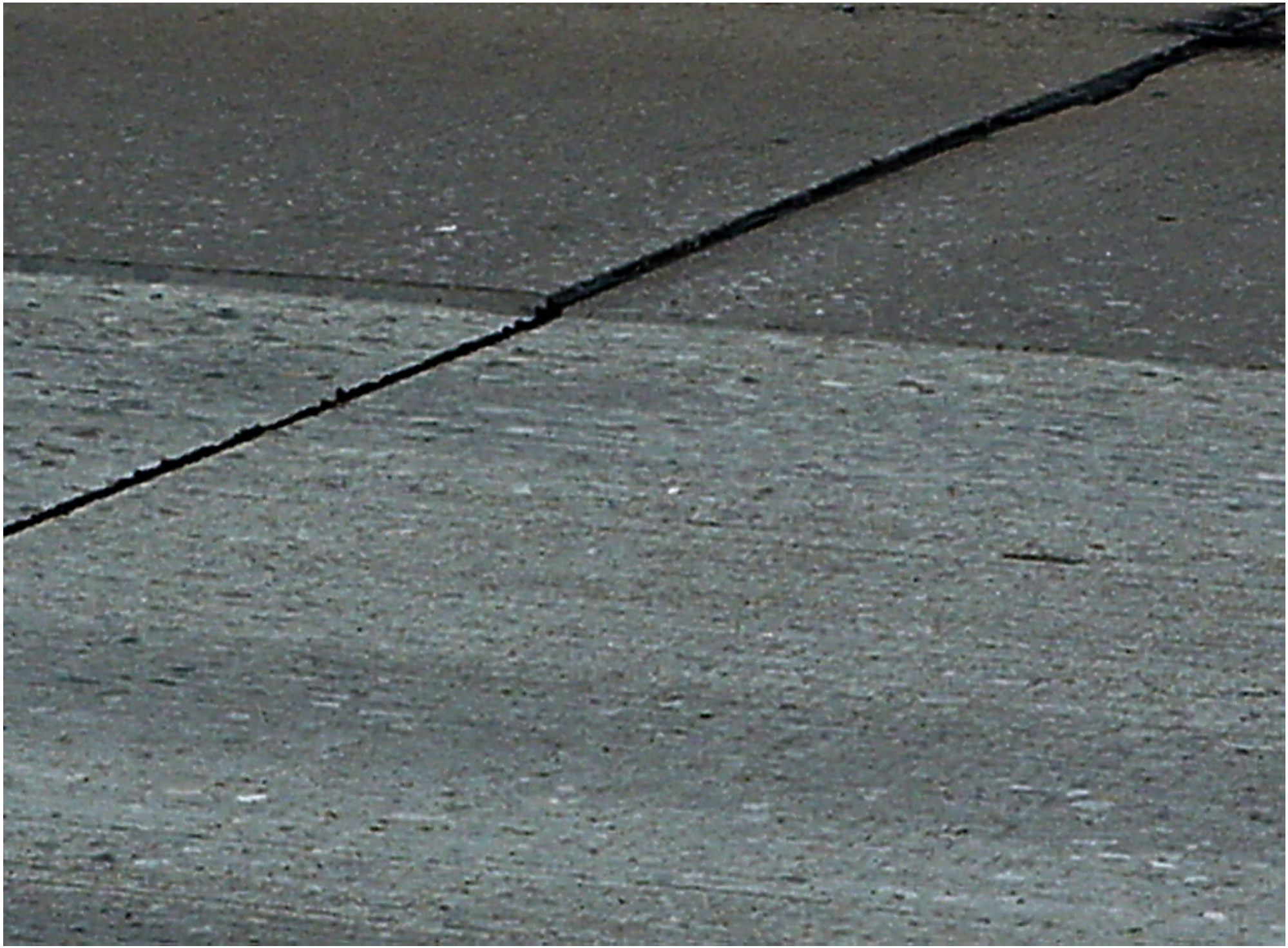
- Built-in or construction roughness
- Polished pavement surfaces - friction
- Wheel-path rutting
- Inadequate transverse slope
- Unacceptable noise level

PCC Pavement

Pavement Problems Addressed

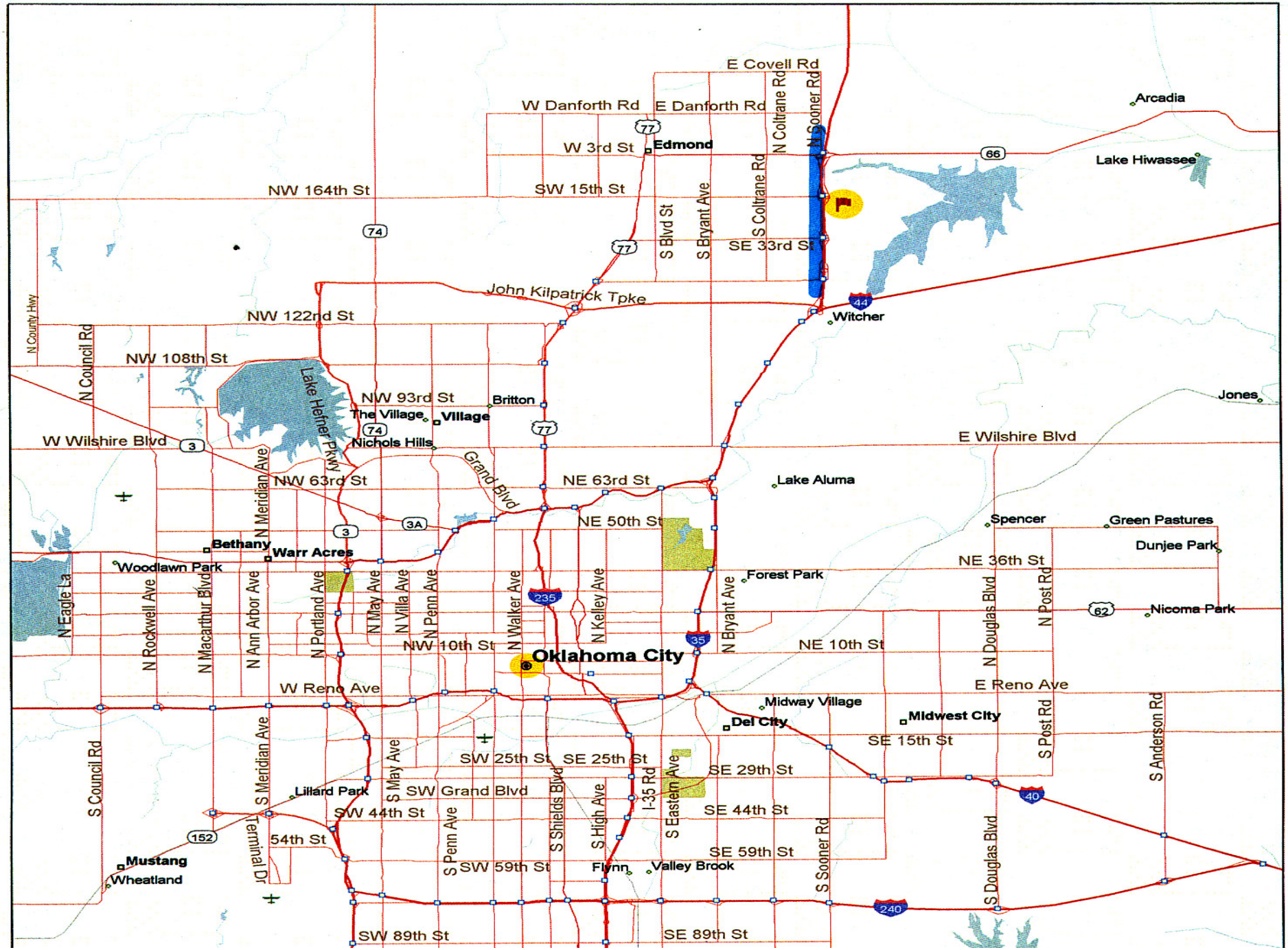
- Faulting at joints and cracks
- Built-in or construction roughness
- Polished concrete surface
- Wheelpath rutting
- Inadequate transverse slope
- Unacceptable noise level

Faulted Joints

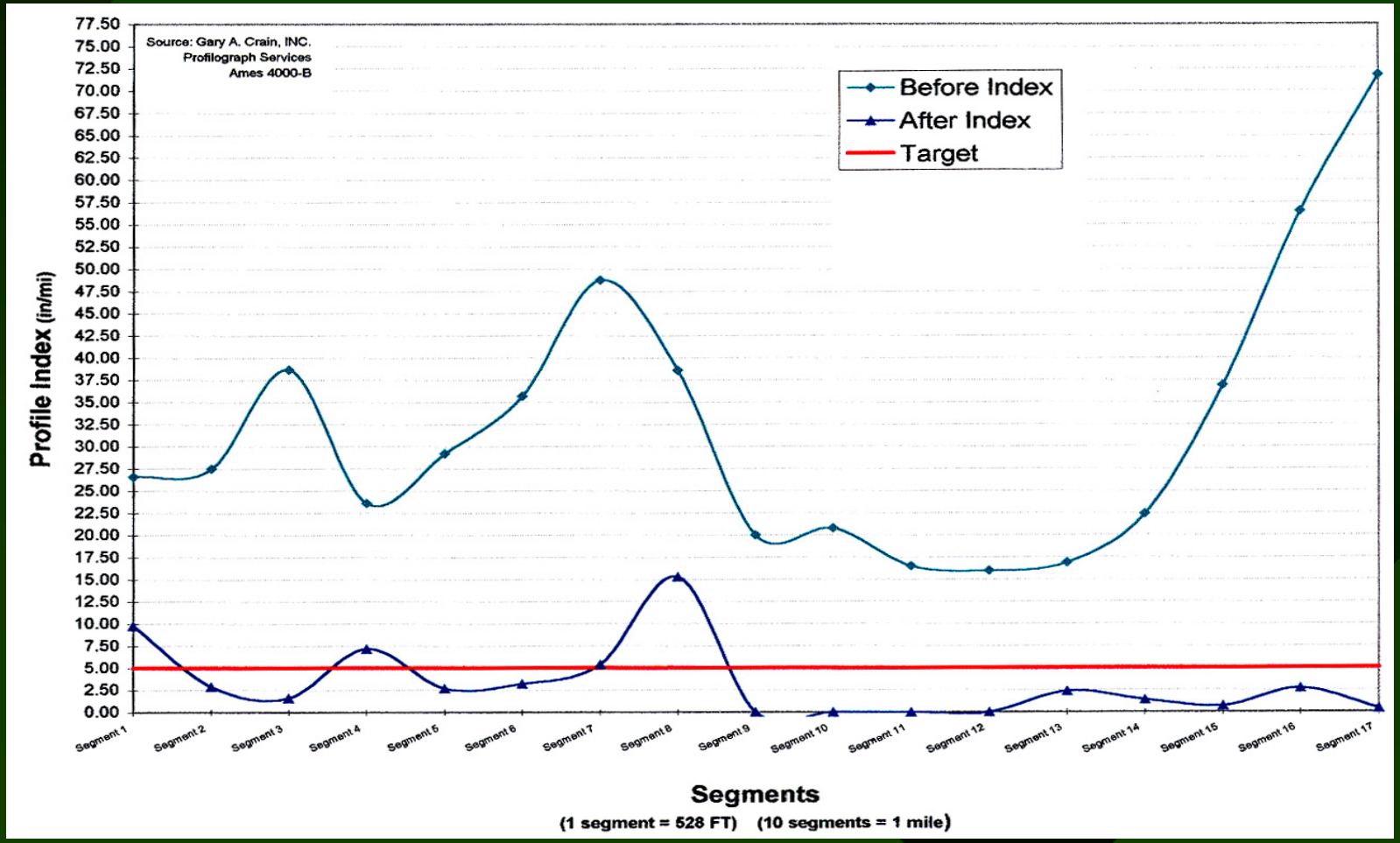


Diamond grinding will significantly increase smoothness over the pre-grind profile!

I-35 Grinding Project



Before & After



Polished Surface

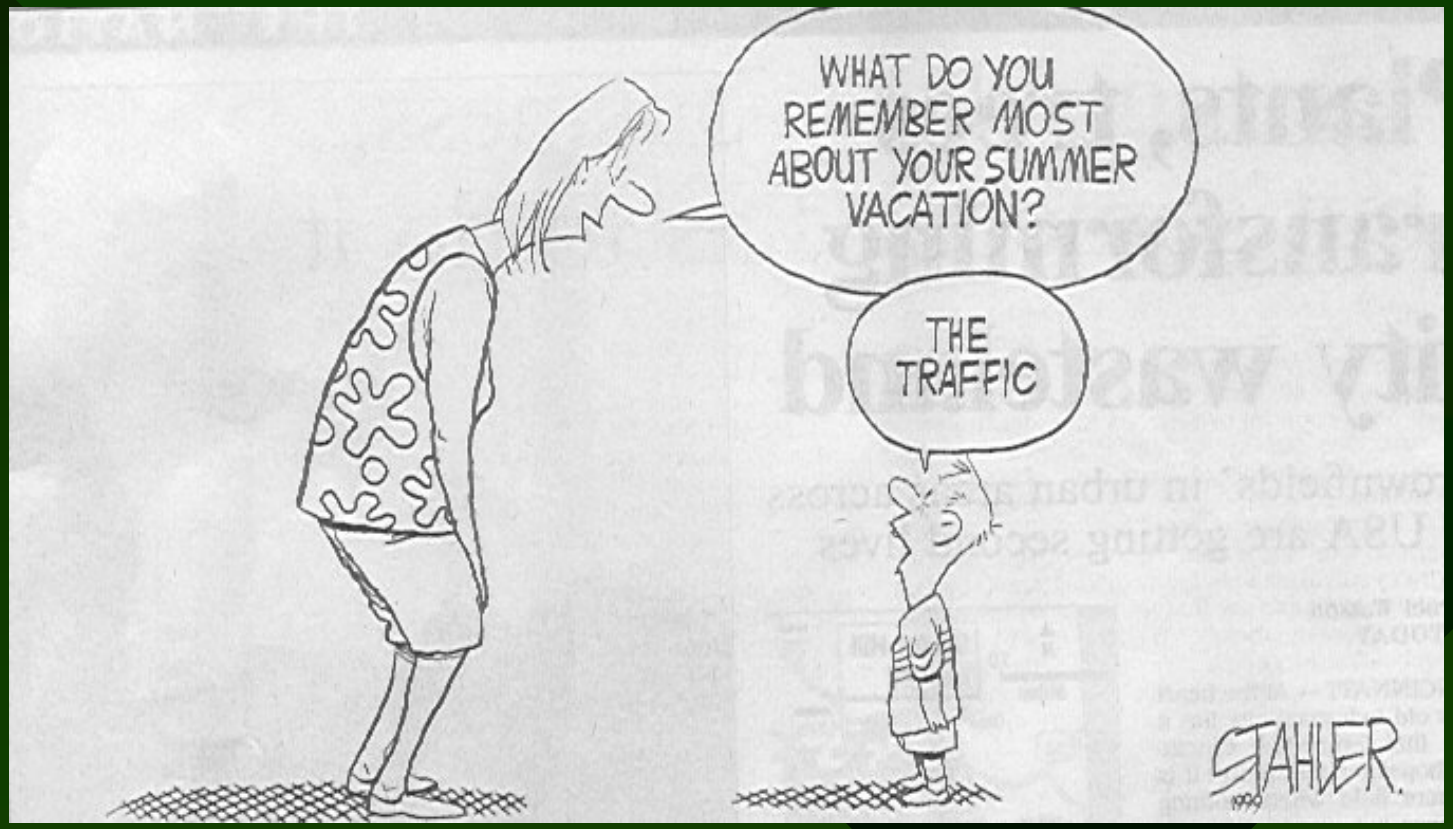
Safety, Surface Texture and Friction

- Improvement in friction number and skid resistance due to increase in pavement macrotexture
- Longitudinal texture provides directional stability and reduces hydroplaning (side-force friction)
- In Wisconsin, overall accident rates for ground surfaces were 40% less than for un-ground surfaces over a 6-year period, 57% in wet weather conditions(Drakopoulos et al. 1998)

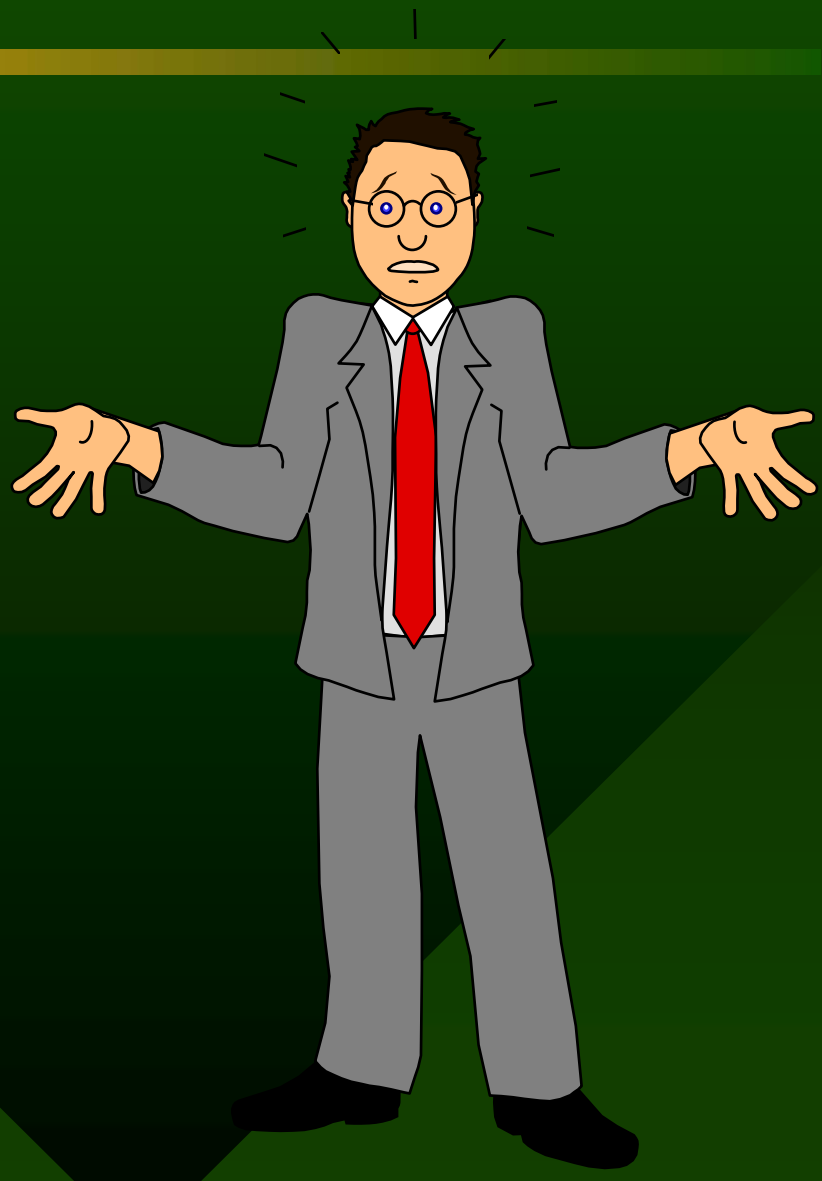
MODOT- Safer, Smoother, Sooner

- MODOT initiates Safer, Smoother, Sooner program in 2005 – To be completed December 2007
- The initiative invests $400 million in 2,200 miles of Missouri's roads that carry 60 percent of the traffic and are within 10 miles of where 86 percent of Missouri's residents live.
- Improve customer satisfaction through
  - Safer pavements
  - Smoother ride quality
  - Quiet ride quality
- Approx 8,000,000 sq yds let in 1st Qtr 2005 alone

Traffic Control



So what is all this noise about diamond grinding in Arizona?!?



SR 202 56st WB PCCP Grinding

Prepared by Larry Scofield
Preliminary Draft 6/6/03

1

Diamond Grinding
Benefits Reported by Arizona DOT - 2003

- Restored smoothness
- Improved friction
- Improved cross slope
- Reduction in noise

Grinding

Diamond Grinding
Effect on Roughness - ADOT

58 Percent decrease in IRI

Test Area	Lane 1	Lane 2	Lane 3
1	59%	56%	NA
2	NA	NA	53%
3	64%	60%	NA
4	NA	NA	55%

NA = Not applicable

Grinding

Diamond Grinding
Effect on Friction - ADOT

27 Percent increase in friction

Test Area	Lane 1	Lane 2	Lane 3
1	25%	15%	NA
2	NA	NA	18%
3	41%	35%	NA
4	NA	NA	26%

NA = Not applicable

Grinding

Diamond Grinding
Effect on Tire/Pavement Noise - ADOT

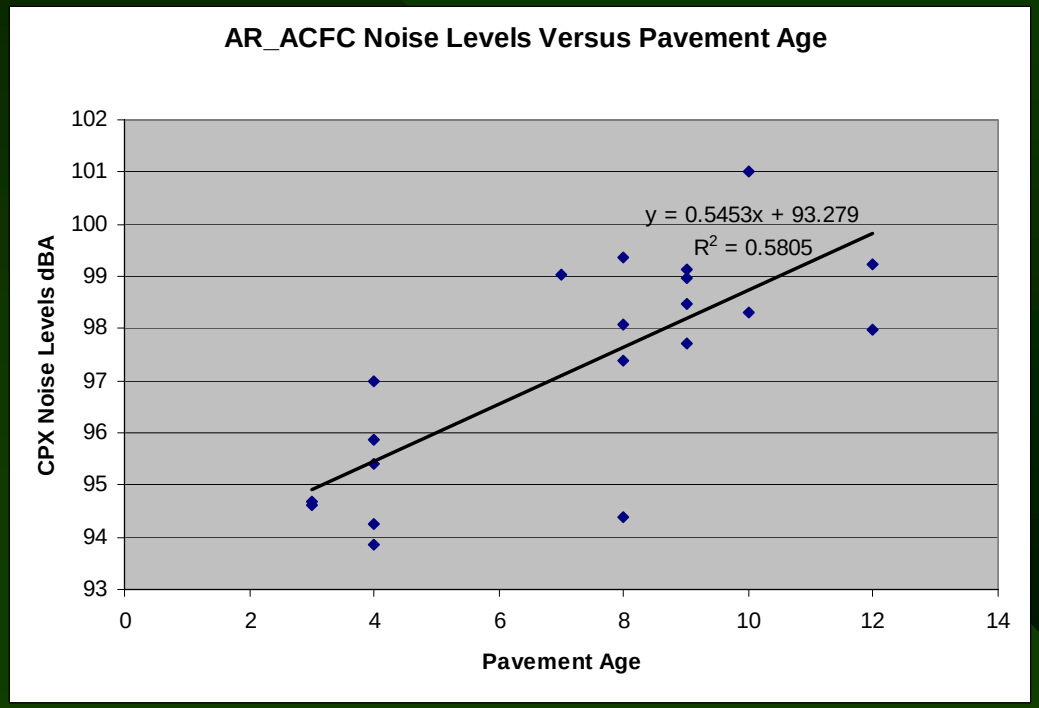
Arizona PCCP Noise Generation (Near Field)

Test Area	Lane 1	Lane 2	Lane 3
1	96.6	96.4	NA
2	NA	NA	98.1
3	98.5	95.6	NA
4	NA	NA	95.5

NA = Not applicable

Grinding

Typical ARFC Noise Research Results - ADOT



- "The results shown represent the average of twenty projects. The projects were located on I-8, and I-10, and ranged in age from three years to twelve years. The regression indicates approximately a 5 dBA increase in noise generation in a ten year period. The current data further indicates that AR-ACFCs typically range from 94 to 99 dBA throughout their life."

THE ULTIMATE QUESTION!

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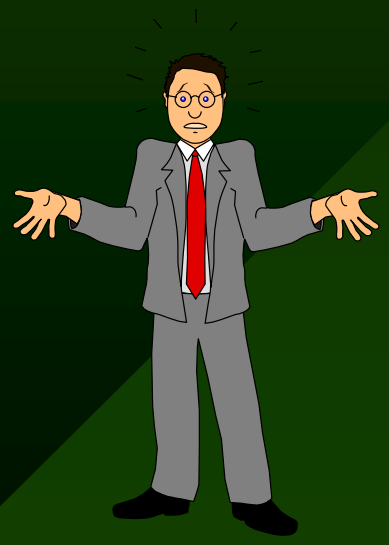

Summary

- Diamond grinding can extend pavement life significantly at a competitive cost.
- Diamond grinding is a key Preventive Maintenance tool.
- Diamond grinding will increase customer satisfaction, increase friction, reduce noise and reduce life cycle costs.
- Performance and cost vary with given conditions.
- Timing is everything.
- ACPA and IGGA are ready to assist!

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